Thysanoptera of Lamington National Park, Australia, collected during the IBISCA-Queensland Project

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ABSTRACT

We documented species of thrips (Thysanoptera) collected during the IBISCA-Queensland Project, an altitudinal study in subtropical rainforest at Lamington National Park, Queensland, Australia. Thrips were identified from samples collected by four methods, leaf litter extracts, Malaise traps, flight interception traps and yellow pan traps, conducted at four plots at each of five altitudinal zones (300, 500, 700, 900 and 1100 metres above sea level) in October 2006 and January and March 2007. A total of 61 thrips species from three families were recorded from these samples. An additional 20 species were recorded from Lamington National Park by targeted collecting for thrips, mostly beating live and dead foliage and branches, bringing the total thrips fauna to 81 species. Biogeographically, the most interesting record was a new species breeding in the flowers of *Pentaceras australis*, *Cranothrips ibisca*, the only eastern species in a western and arid zone genus. ❐ *Thysanoptera, Aeolothripidae, Melanthripidae, Thripidae, Phlaeothripidae, IBISCA-Queensland, altitude.*

The IBISCA-Queensland project was designed to document the current distributions of a range of invertebrate taxa and plants along an altitudinal gradient within continuous rainforest in Lamington National Park, south-east Queensland (see Kitching *et al.* 2011). Twenty permanent study plots were established within the West Canungra Creek catchment of the Green Mountains Section of the park; four replicate plots at each of five zones of elevation (300, 500, 700, 900 and 1100 metres above sea level (a.s.l.)) (see Kitching *et al.* 2011 for precise localities of plots). Between October 2006 and March 2007 baseline sampling of invertebrates was conducted on these plots using a variety of sampling methods. Here we report on species of thrips (Thysanoptera) collected by this baseline sampling as well as additional species collected by targeted hand collecting on the IBISCA-Queensland study plots and elsewhere in the Green Mountains Section of Lamington National Park.

The Thysanoptera, the insect order commonly known as thrips, includes almost 800 described species from Australia (ABRS 2011), out of a world total of about 6000 species (Mound 2011). However, judging from slide-mounted species available in collections at Canberra and Brisbane, it seems likely that an equal number of species remain undescribed from Australia. Estimating the potential size of this fauna is difficult, as thrips populations are commonly

strongly aggregated. As a result, standardised collecting methods based on randomised sampling usually acquire few specimens, although of a considerable diversity of species. However, most thrips species are polymorphic to some extent, and many species are highly polymorphic, such that identification of isolated individuals is not possible. Hand-collecting by specialists is a more effective method of acquiring large samples from strongly aggregated populations, and has the advantage of producing valuable data on host-plant associations and structural variation. But specialist collecting is limited by constraints of time and number of localities sampled. In attempting to contribute to the objectives of IBISCA-Queensland Project (see Kitching *et al.* 2011), we compromised between the above sampling methods. The yield of specimens from within the twenty IBISCA-Queensland study plots was far too low to produce generalisations (Table 1 & 2), and time and space limited the amount of hand collecting that could be achieved. Here we list the thrips species found at Lamington National Park based on our own collecting and available IBISCA-Queensland samples.

METHODS

We examined thrips that had been extracted from samples collected by four of the IBISCA-Queensland baseline sampling methods; Tullgren funnel leaf litter extracts, Malaise traps, flight interception traps (FIT) and yellow pan traps. A single sample from each method was collected from all twenty IBISCA-Qld study plots (4 plots at each elevation, 300, 500, 700, 900 and 1100 m a.s.l.) on three occasions, October 2006, January 2007 and March 2007 (see Kitching *et al.* 2011 for more details). Samples were collected from within a permanent 20 m x 20 m quadrat established in the centre each plot. In total 132 samples containing thrips were examined.

Each litter sample was derived from 1 litre of unsifted leaf litter collected from a single location within the central quadrat of each plot and extracted with a Tullgren funnel for 6 days. Each Malaise trap sample was collected with a Townes type trap operated for 10 days (see Lambkin *et al.* 2011 for more details). Each FIT sample was obtained from a single trap operated for 10 days. Each flight interception trap consisted of a vertical rectangular panel (66 cm x 70 cm) of layers of plastic kitchen wrap above a rectangular collecting container (14 cm x 66 cm) raised above ground level and filled with propylene glycol. Each yellow pan trap sample consisted of three rectangular plastic food containers (approximately 165 mm x 110 mm) placed on ground within the central quadrat and operated for three days. Catches from the three traps pooled into one sample.

In addition to the baseline collecting methods, we conducted targeted collecting for thrips on 9-11 October 2006 and 12-13 March 2007. This mainly involved hand collecting by beating living foliage and flowers, and dead leaves and branches over a white plastic tray. In addition we collected a few thrips from leaf litter and by spraying tree trunks with pyrethroid insecticide. Some of this additional hand collecting was undertaken on the IBISCA-Qld study plots at 900, 700 and 300 m a.s.l., but we also collected in rainforest along walking tracks (Border, Elabana Falls, Wishing Tree and Moran Falls Tracks) mostly between 700 and 950 m a.s.l. We also collected in open areas in the vicinity of O'Reilly's Rainforest Resort and the Green Mountains camping and parking areas.

Adult specimens from nearly all collections were slide-mounted and identified to described species and genera where possible. Specimens have been deposited in the Queensland Primary Industries Insect Collection (QDPC), Brisbane and the Australian National Insect Collection (ANIC), Canberra.

RESULTS

Overall, 211 adult thrips and 45 immature thrips were present in a total of 132 IBISCA-Qld baseline samples examined (16 leaf litter extracts, 31 Malaise, 34 FIT, 51 yellow pan, Table 1). Unfortunately adult thrips were uncommon in samples; only 3 of the 132 samples contained more than 5 adults (the maximum was 8 in a flight interception trap), with many containing only single specimens. Also, nine adult thrips collected from these traps were too damaged to identify, however, the other 202 adult thrips represented 61 species from 3 families. Malaise traps collected the greatest diversity of species and leaf litter showed the least diversity species. Flight interception traps collected the highest numbers of adult thrips with leaf litter extracts yielding the lowest numbers (Table 1). Additional targeted collecting of thrips from IBISCA-Qld plots and elsewhere yielded 41 species, including 20 not collected by the baseline sampling methods. Therefore, combined baseline and targeted collecting methods yielded a total of 81 thrips species from 4 families from Lamington National Park, including 11 species unrecognisable at generic level (Table 2).

The two most common species in the baseline samples were *Thrips setipennis* (total specimens = 35), a common flower feeding species, and *Psalidothrips* sp. (total specimens = 24) a common fungal feeder usually found in leaf litter. However, recently the latter species has been collected by the authors on hanging dead leaves in northern Queensland, and *Psalidothrips* sp. was also captured in flight interception traps.

Larvae were collected by all four baseline sampling methods with most in leaf litter extracts (Table 1) from the lower altitudes of 300 and 500 m a.s.l. The collection of larvae in the Malaise and flight interception traps suggests that they can be carried by wind currents. Very few pupae were found, suggesting they are not carried by the wind and that in leaf litter they may burrow deeper into the soil to pupate. It is usually not possible to identify unassociated larvae and pupae of thrips species.

Biogeographically there were few surprises in the fauna, although the IBISCA-Qld sites seemed to sit on the border between the southern and northern thrips faunas of eastern Australia. The most significant record was a new species of Melanthripidae, *Cranothrips ibisca* Pereyra & Mound, breeding in the flowers of *Pentaceras australis* (Rutaceae). This genus is found mainly in the west and centre of Australia, and this is the first record from the east of the continent.

Individual baseline sampling methods

Leaf litter extracts. Of the 16 leaf litter extracts, 59% contained ≤ 1 adult thrips, 35% between 2 and 5 adults, and 6% more than 5 adults. Nearly all specimens, including larvae were collected at the lower altitudes of 300 and 500 m a.s.l. (Table 2). Only one thrips family was collected in leaf litter, the Phlaeothripidae (Idolothripinae and Phlaeothripinae). One species of Idolothripinae was collected, *Allothrips stannardi*, and this is common in leaf litter in eastern Australia (Mound 1972). Three species of Phlaeothripinae, a group with a diverse range of biologies including feeding on fungal hyphae or plant cells, or predation (Crespi *et al.* 1997; Mound & Morris 2005), were collected in low numbers. Highest numbers of thrips in leaf litter were collected at 300 m a.s.l. in March 2007, and these were mainly *A. stannardi* (Table 2).

Malaise traps. Of the 31 Malaise trap samples examined, 52% contained ≤ 1 adult thrips, 48% between 2 and 5 adults, and none contained more than 5 adults. Representatives of three thrips families were collected; Aeolothripidae, Phlaeothripidae (Phlaeothripinae and Idolothripinae) and Thripidae (Thripinae, Sericothripinae, Panchaetothripinae and Dendrothripinae). Aeolothripids are generally predatory (Mound & Marullo 1998), Thripinae feed on flowers and young leaves (Mound &

TABLE 1. Total number of individuals of different thrips life stages and species (species identified only from adults) collected by four IBISCA-Queensland baseline sampling methods. Data from samples collected across five different altitudinal zones (300, 500, 700, 900 and 1100 m a.s.l.) combined. Numbers in parentheses are those adults that were too damaged to identify.

Collect. method	No. adults	No. species	Phlaeothripidae larvae	Phlaeothripidae pupae	Thripidae larvae	Total samples
Leaf litter	26 (0)	6	18	2	0	16
Malaise	58 (1)	33	5	0	0	31
FIT	65 (4)	21	7	0	0	34
Yellow pan	53 (4)	26	7	0	6	51
Total	202 (9)	61	37	2	6	132

Gillespie 1997), Dendrothripinae feed on young leaves (Mound 1999), and Panchaetothripinae (Mound & Gillespie 1997) generally feed on older leaves. Highest numbers of specimens and species were collected at 900 m a.s.l. and during March 2007, and low numbers at 300 and 1100 m a.s.l. and during October 2006. Malaise trap samples were not dominated by any particular species with all represented by between one and five specimens (Table 2).

Flight interception traps. Of the 34 samples collected by flight interception traps, 56% contained ≤ 1 adult thrips, 38% between 2 and 5 adults, and 6% more than 5 adults. As with Malaise traps, three thrips families were collected; Aeolothripidae, Phlaeothripidae (Phlaeothripinae and Idolothripinae) and Thripidae (Thripinae, Dendrothripinae, and Panchaetothripinae). The highest numbers of specimens and species were collected at 300 m a.s.l. and during October 2006, with lower numbers at 500 and 1100 m a.s.l. and in January 2007. The most common species were *Psalidothrips* sp. (20 specimens), *Thrips setipennis* (17) and *Hoplandrothrips* sp. (6) with all other species represented by one or two specimens (Table 2).

Yellow pan traps. Out of the 51 samples collected by yellow pan traps, 77% contained ≤ 1 adult thrips, 23% between 2 and 5 adults, and none contained more than 5 adults. Only two thrips families were collected, Phlaeothripidae (Phlaeothripinae and Idolothripinae) and Thripidae (Thripinae, Dendrothripinae, and Panchaetothripinae). The numbers of specimens and species were spread fairly evenly over the five altitudes. The most common species were *Thrips setipennis* (14 specimens) and *Parthenothrips dracaenae* (9) with all other species represented by only one or two specimens (Table 2).

DISCUSSION

Within rainforest, a large proportion of thrips species are likely to live on the leaves, flowers and dead branches in the canopy, and for this group of insects the absence of sampling from the tree canopy was particularly unfortunate. Fungus feeding thrips species live on the bark of trees and in leaf litter on the ground, and these were better sampled by the IBISCA-Queensland collecting methods. Understorey shrubs and ferns in the deep shade within rainforest usually support few thrips species, although at Lamington the flowers of *Livistona* palms carried large numbers of the common flower thrips, *Thrips setipennis*. The white flowers of these palms were presumably strongly attractive within the area of low light intensity; large numbers of this flower thrips were similarly noted to land on the white plastic trays that are commonly used for sampling thrips from vegetation. Hand collecting was effective only at breaks in the forest canopy, at tree falls, along the preformed footpaths, and at forest edges. By far the largest number of thrips species was taken

TABLE 2. Checklist of 81 thrips species recorded from the Green Mountains Section of Lamington National Park and the numbers of adult specimens collected from the 20 IBISCA-Queensland study plots stratified by altitude (m a.s.l.), collecting method (LL – leaf litter extract, MT – Malaise Trap, FIT – flight interception trap, YP – yellow pan trap) and sampling time (October 2006, January 2007 and March 2007). Species also recorded by targeted collecting for thrips on the IBISCA-Qld plots and elsewhere in the park, indicated by tick marks.

	Total specimens	Altitude (m a.s.l.)					Sampling methods				Sampling period			Target sampling
		300	500	700	900	1100	LL	MT	FIT	YP	Oct 2006	Jan 2007	Mar 2007	
TEREBRANTIA														
Aeolothripidae														
Andrewarthia kellyana (Bagnall)	2			1	1			1	1		2			✓
Desmothrips bagnalli Karny														✓
Desmothrips tennicornis (Bagnall)	2		1	1				2				1	1	
Erythridothrips cubilis Mound & Marullo														✓
Lamprothrips sp.n.														✓
Melanthripidae														
Cranothrips ibisca Pereyra & Mound														✓
Thripidae														
Dendrothripinae														
Anisopilothrips venustulus (Priesner)	2	2								2			2	
Dendrothrips diaspora Mound	1			1						1	1			
Ensiferothrips primus Bianchi	1		1					1			1			
Ensiferothrips sp. nov.	2				1	1				2	2			✓
Leucothrips nigripennis Reuter	1		1							1			1	
Panchaetothripinae														
Bhattithrips frontalis (Bagnall)	2	1		1				1	1			1	1	
Caliothrips striatopterus (Kobus)	1				1					1	1			
Hercinothrips femoralis (Reuter)	2	1	1							2			2	
Heliothrips haemorroidalis (Bouché)	5	2		2	1			2	1	2	1		4	✓
Parthenothrips dracaenae (Heeger)	10	3	1	4		2		1		9	4		6	
Phibalothrips longiceps (Karny)	1	1						1				1		
Sericothripinae														
Hydatothrips williamsi Mound & Tree	1				1			1					1	

TABEL 2. cont...

	Total specimens	Altitude (m a.s.l.)					Sampling methods				Sampling period			Target sampling
		300	500	700	900	1100	LL	MT	FIT	YP	Oct 2006	Jan 2007	Mar 2007	
Thripinae														
Anaphothrips sp.														✓
Chaetanaphothrips sp.														✓
Frankliniella occidentalis (Pergande)	1					1				1	1			
Frankliniella schultzei (Trybom)	1				1			1				1		
Mycterothrips desleyae Masumoto & Okajima														✓
Pezothrips kellyanus (Bagnall)	1	1								1	1			✓
Pseudanaphothrips pallidus (Steele)	1			1						1	1			✓
Pseudanaphothrips sp.	1			1					1				1	✓
Scirtothrips albomaculatus Bianchi														✓
Thrips australis (Bagnall)	1			1						1	1			✓
Thrips coloratus Schmutz	1				1				1				1	
Thrips imaginis Bagnall	2		1			1		1		1	1		1	✓
Thrips setipennis (Bagnall)	35		4	7	7	17		4	17	14	31	2	2	✓
Thrips tabaci														✓
Trichromothrips sp. nov.	1				1			1				1		✓
TUBULIFERA														
Phlaeothripidae														
Idolothripinae														
Acallurothrips sp.														✓
Allothrips staunardi Mound	10	10					10					2	8	✓
Bactrothrips sp.														✓
Carieutothrips sp. nov.														✓
Carientothrips mjobergi ag.	2			1	1			1	1		1		1	✓
Ecacleistothrips glorious Mound	1	1						1				1		
Ethirothrips sp.	1				1			1					1	✓
Idolothrips dissimilis Girault	1			1						1			1	✓

TABEL 2. cont...

	Total specimens	Altitude (m a.s.l.)					Sampling methods				Sampling period			Target sampling
		300	500	700	900	1100	LL	MT	FIT	YP	Oct 2006	Jan 2007	Mar 2007	
Idolothrips spectrum Haliday														✓
Nesothrips propinquus (Bagnall)														✓
Phaulothrips sp. nov.	2			1	1			2					2	
Gen. nr. *Celidothrips*	1			1						1			1	
Gen. nr. *Ethirothrips*	2		1		1			2			1		1	
Gen. nr. *Polytrichothrips*	1		1					1				1		
Phlaeothripinae														
Baenothrips moundi (Stannard)	2		2					1		1	1		1	
Deplorothrips sp.	2				2				2				2	
Enoplothrips bagnalli Hood														✓
Gen. nr. *Gynaikothrips*	5	2		2	1			5				5		
Haplothrips anceps Hood	1				1					1	1			
Haplothrips bituberculatus (Girault)	1			1			1				1			✓
Haplothrips froggatti Hood	1				1			1			1			✓
Haplothrips victoriensis Bagnall														✓
Haplothrips sp.	6	3			2	1		4	2		1	5		✓
Holothrips sp.														✓
Gen. nr. *Hoplandrothrips*					1					1	1			
Hoplandrothrips sp.	8	2		3	3			2	6		2	3	3	
Hoplandrothrips xanthocnemis (Karny)														✓
Hoplothrips melanurus (Bagnall)														✓
Hoplothrips sp.	2	1				1		1	1			1	1	
Horistothrips australiae Morgan	2			2					1	1	1		1	
Katothrips tityrus (Girault)	1	1						1			1			
Leeuwenia diospyri Mound	1			1				1				1		✓
Leeuwenia polyosmae Mound	1					1		1					1	✓
Liothrips sp.	1	1						1				1		✓
Lissothrips sp.	1				1					1			1	

TABEL 2. cont...

	Total specimens	Altitude (m a.s.l.)					Sampling methods				Sampling period			Target sampling
		300	500	700	900	1100	LL	MT	FIT	YP	Oct 2006	Jan 2007	Mar 2007	
Lititetothrips sp.	5				2	3		2	1	2		1	4	
Psalidothrips taylori Mound & Walker	2	2							2				2	
Psalidothrips sp.	24	12	3	6	3			3	20	1	5	8	11	✓
Stigmothrips/Adraneothrips	4	1	3				4				1		3	
Teuchothrips sp.	7	2	2			3		5	2			2	5	✓
Xylaplothrips sp.	3	2	1				1			2	1		2	
Zeniathrips biseta Mound	3	3					3					3		
Gen. nov. Phlaeo "F"	8	2	6				7		1		4	1	3	
Gen. nov. Phlaeo "H"	1			1					1		1			
Gen. nov. Phlaeo "J"	2			1	1				1	1			2	
Gen. nov. Phlaeo "K"	1				1			1			1			
Gen. nov. Phlaeo "L"	2	2							1	1			2	
Gen. nov. Phlaeo "M"	5		1	2	2			4	1		2	2	1	
Total species	61	23	16	23	26	10	6	33	21	26	31	21	36	41
Total adults	202	58	30	43	40	31	26	58	65	53	75	44	83	

on trees, shrubs and herbs around the car park at O'Reilly's Rainforest Resort at approximately 900 m a.s.l. *Haplothrips victoriensis* was found in particular abundance around this site, on a range of plants. This species is typical of southern Australia (Mound & Minaei 2007), with a natural distribution scarcely extending into Queensland. High populations at the O'Reilly's Rainforest Resort car park probably result from southerly winds transporting this and other thrips species, and depositing them on the ridge of the Lamington forests. Such winds are also considered likely to explain the presence of a recently described species of *Cranothrips* from the same site (Pereyra & Mound 2009).

Almost all of the species in the suborder Terebrantia listed in Table 2 were found at forest edges by hand collecting. These are flower- and leaf-living species, and all are common at ground-level. In contrast, among the Aeolothripidae, *Erythridothrips* and *Lamprothrips* species are rarely collected and are thought likely to live in the canopy. Among the Tubulifera, the species of the subfamily Idolothripinae are assumed all to feed by ingesting fungal spores (Mound & Palmer 1983; Mound 2007) and the listed species were taken within the forest from dead branches, hanging dead leaves, or from tree trunks. Of the subfamily Phlaeothripinae, about half of the listed species are fungus-feeding, presumably on fungal hyphae (Mound 2007) and these similarly live particularly in leaf-litter but also on dead branches and tree trunks. The remaining Phlaeothripinae are known to be associated with living plant tissues.

Three of the *Haplothrips* species are certainly not associated with forests, although *H. bituberculatus* is apparently a predatory species that lives on dead branches and is sometimes taken within forests (Mound & Minaei 2007). The recorded species of *Leeuwenia* (Mound 2004) and *Liothrips* (Mound & Morris 2005) are gall-inducing, host-specific species, and this is probably also true of the *Gynaikothrips* and *Litotetothrips* species for which no host has yet been established. *Euoplothrips bagnalli* is a kleptoparasite within the galls of other thrips in rainforest (Marullo 2001; Mound & Morris 2005) and was found within *Liothrips* galls on *Piper novae-hollandiae*.

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LITERATURE CITED

ABRS 2011. http://www.environment.gov.au/biodiversity/abrs/

Crespi, B.J., Carmean, D.A. & Chapman, T.W. 1997. Ecology and evolution of galling thrips and their allies. *Annual Review of Entomology* **42**: 51-71.

Kitching, R.L., Putland, D., Ashton, L.A., Laidlaw, M.J., Boulter, S.L., Christensen, H. & Lambkin, C.L. 2011. Detecting biodiversity changes along climatic gradients: the IBISCA-Queensland Project. *Memoirs of the Queensland Museum – Nature* **55**(2): 235-250.

Lambkin, C.L., Boulter, S.L., Starick, N.T., Cantrell, B.K., Bickel, D.J., Wright, S.G., Power, N., Schutze, M.K., Turco, F., Nakamura, A. & Burwell, C.J. 2011. Altitudinal and seasonal variation in the family-level assemblages of flies (Diptera) in an Australian subtropical rainforest: one hundred thousand and counting. *Memoirs of the Queensland Museum – Nature* **55**(2): 315-331.

Marullo, R. 2001. Gall thrips of the Austro-Pacific genus *Euoplothrips* Hood (Thysanoptera), with a new species from Australia. *Journal of Insect Systematics and Evolution* **32**: 93-98.

Mound, L.A. 1972. Polytypic species of spore-feeding Thysanoptera in the genus *Allothrips* Hood (Phlaeothripidae). *Journal of the Australian Entomological Society* **11**: 23-36.

Mound, L.A. 1999. Saltatorial leaf-feeding Thysanoptera (Thripidae: Dendrothripinae) from Australia and New Caledonia with newly recorded pests of ferns, figs and mulberries. *Australian Journal of Entomology*. **38**: 257-273.

Mound, L.A. 2004. Australian long-tailed gall thrips (Thysanoptera: Phlaeothripinae, Leeuweniini), with comments on related Old World taxa. *Australian Journal of Entomology*. **43**: 28-37.

2007. New Australian spore-feeding Thysanoptera (Phlaeothripidae: Idolothripinae). *Zootaxa* **1604**: 53-68.

2011. *Thysanoptera (Thrips) of the World – a checklist*. http://www.ento.csiro.au/thysanoptera/worldthrips.html

Mound, L.A. & Gillespie, P.S. 1997. *Identification Guide to Thrips Associated with Crops in Australia*. (NSW Agriculture: Orange).

Mound, L.A. & Marullo, R. 1998. Biology and identification of Aeolothripidae (Thysanoptera) in Australia. *Invertebrate Taxonomy* **12**: 929-950.

Mound, L.A. & Minaei, K. 2007. Australian insects of the *Haplothrips* lineage (Thysanoptera – Phlaeothripinae). *Journal of Natural History* **41**: 2919-2978.

Mound, L.A. & Morris, D.C. 2005. Gall-inducing Thrips: An Evolutionary Perspective. Pp. 59-72. *In*, Raman, A. Schaefer, C.W. & Withers, T.M. (eds) *Biology, Ecology, and Evolution of Gall-inducing Arthropods*. (Science Publishers, Inc.: Enfield, USA).

Mound, L.A. & Palmer, J.M. 1983. The generic and tribal classification of spore-feeding Thysanoptera

(Phlaeothripidae: Idolothripinae). *Bulletin of the British Museum (Natural History). Entomology.* 46: 1-174.

Pereya, V. & Mound, L.A. 2009. Phylogenetic relationships within the genus *Cranothrips* (Thysanoptera, Melanthripidae) with consideration of host associations and disjunct distributions within the family. *Systematic Entomology* 34: 151-161.